DRAFT

# Impacts of Sea Level Rise on District Operations

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**Water Resources Advisory Commission**
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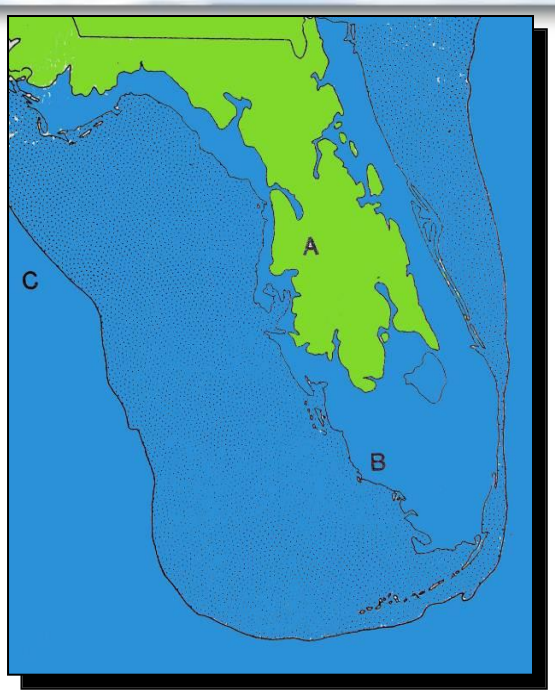
# Outline

- Global and regional sea level rise & projections
- Potential Impacts on District Mission
  - Flood Protection
  - Water Supply
  - Everglades Restoration
- Adaptation
- Future Strategy

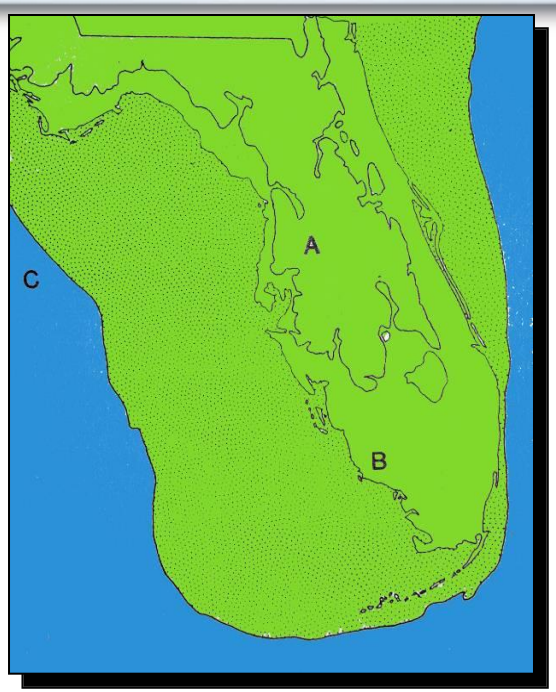
# GLOBAL & REGIONAL SEA LEVELS & THEIR PROJECTIONS

# Florida Through Time – Sea Level Change



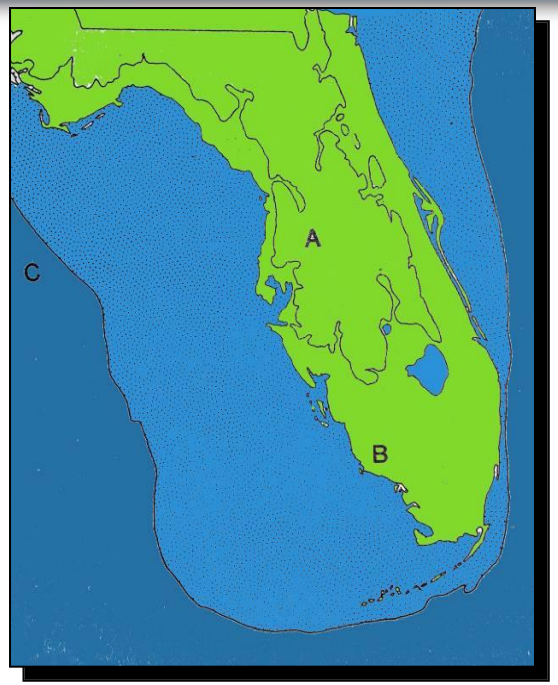

120,000 years ago

+ 6 meters (20')*




18,000 years ago

- 120 meters (420')



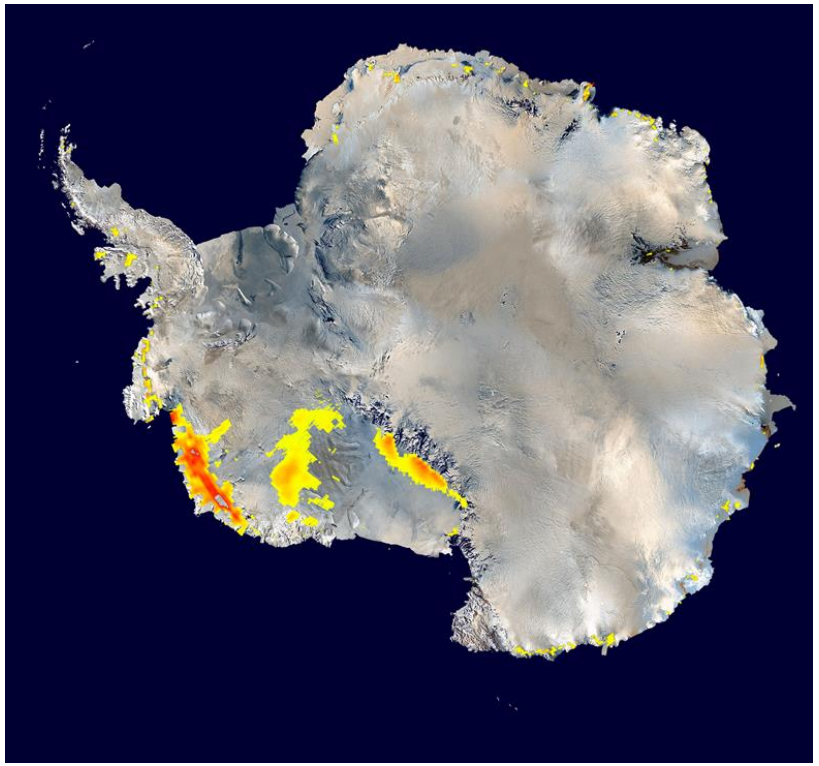

Today

Credit: Dr. Harold R. Wanless; University of Miami, Department of Geological Sciences;

# Why should Arctic and Antarctic regions matter to us?

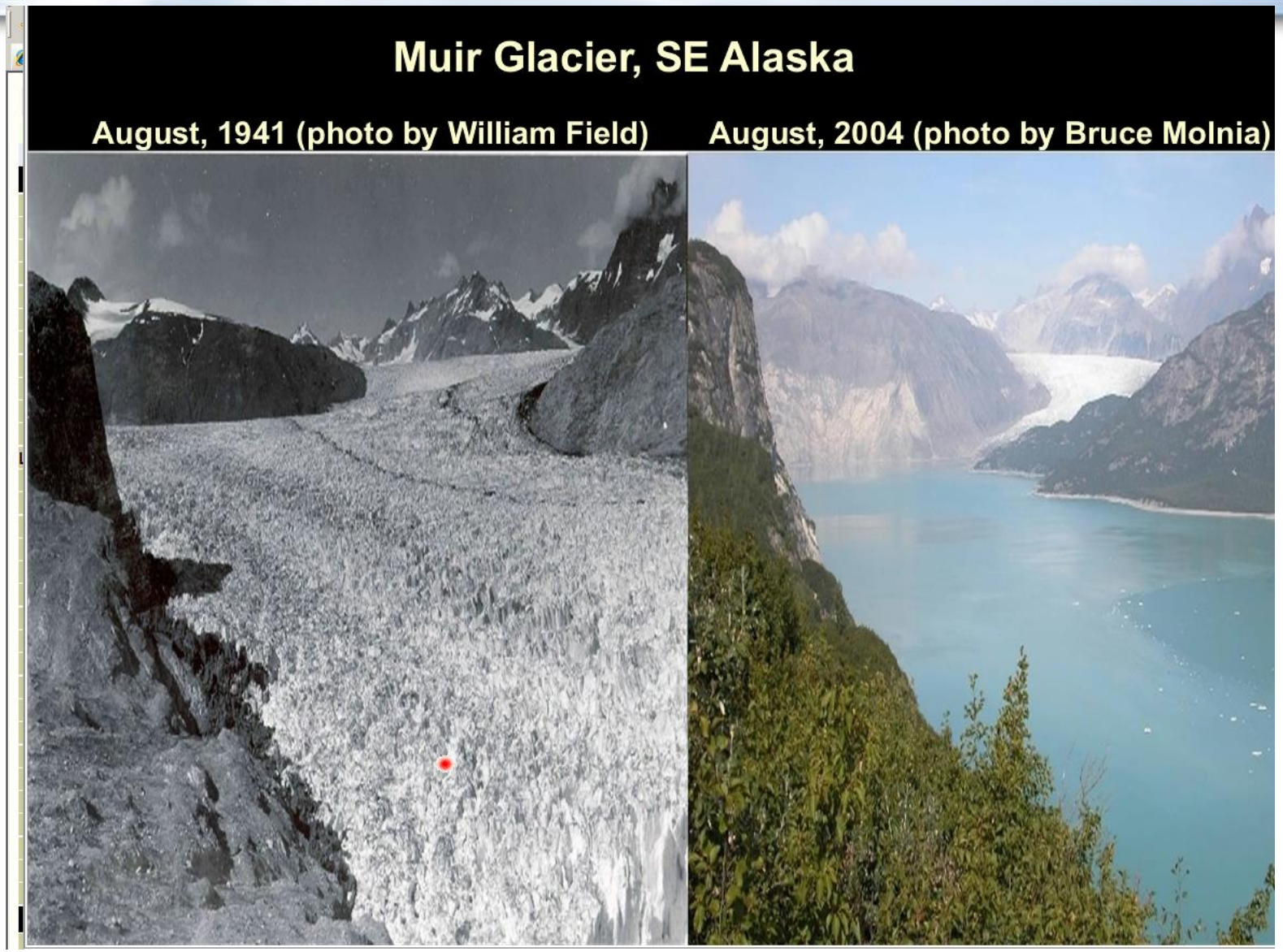
(~ 2 million sq.km.)

(~5.4 million sq. km.)

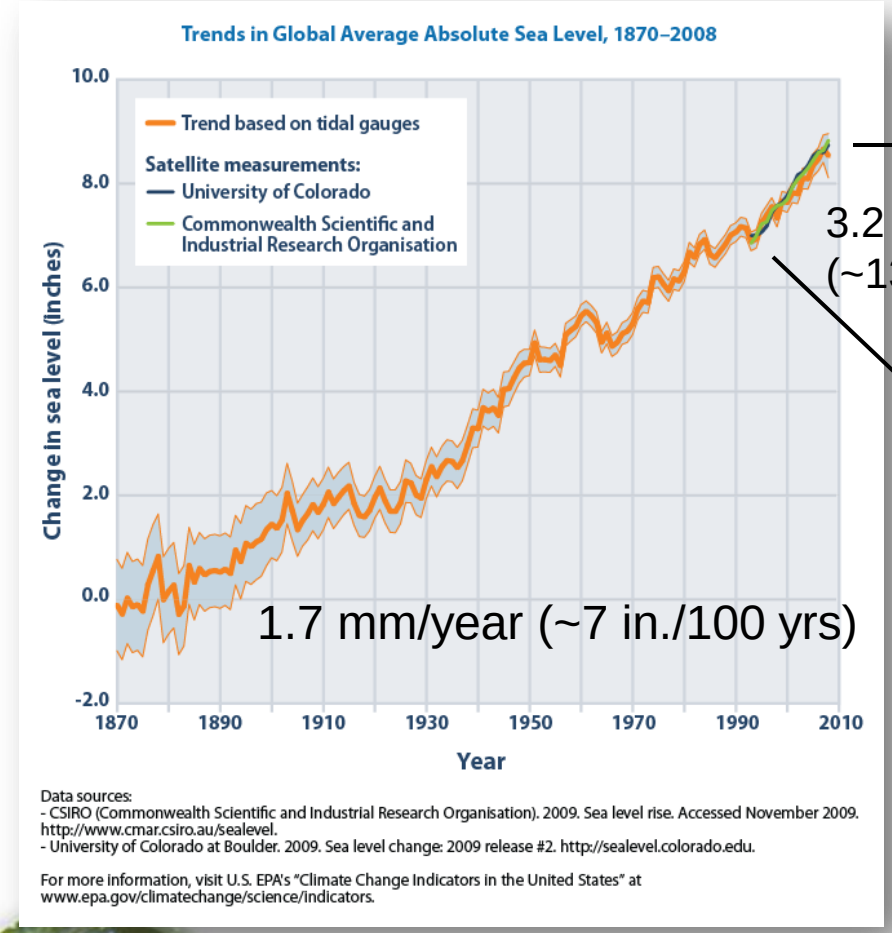


- Enough land ice to drown Florida
- Melt rates uncertain
- Arctic sea ice declining rapidly

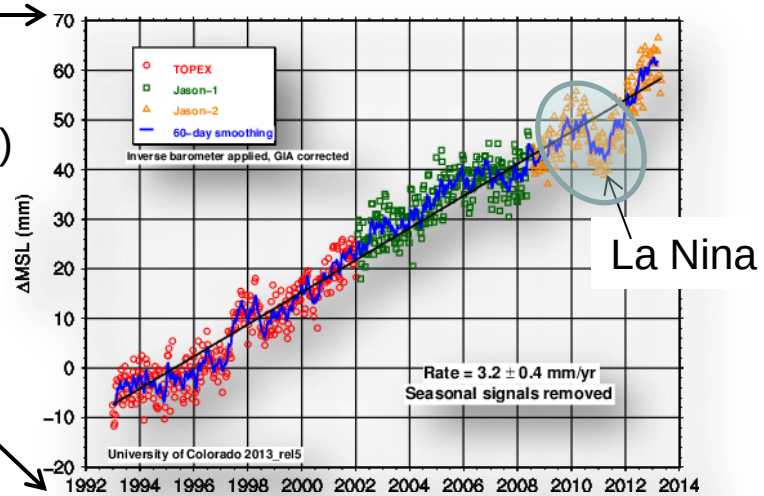
# Glaciers retreating (adding water to ocean)



# Global Average Sea Level Rise-Historical

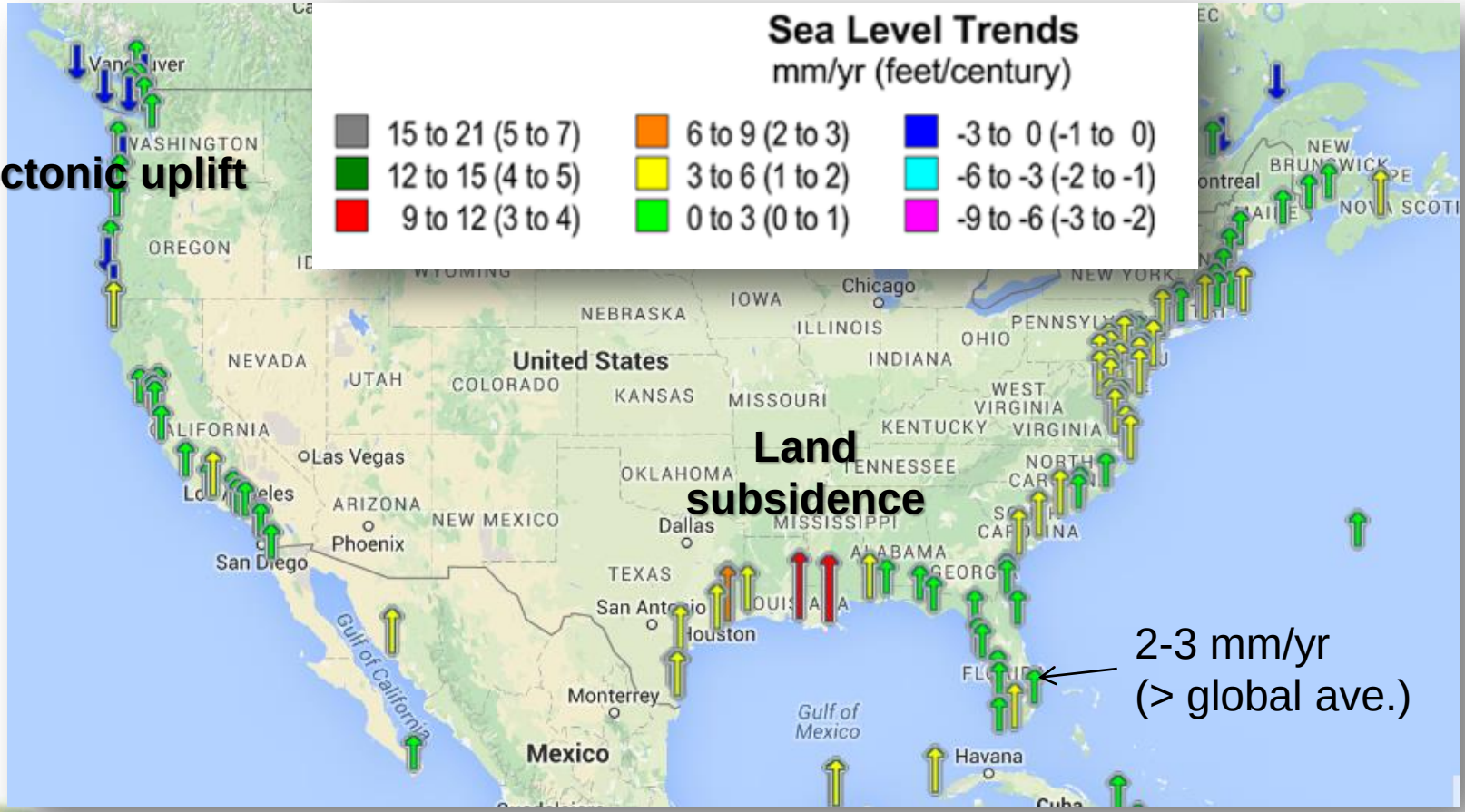



3.2 mm/year
(~13 in/100 yrs)

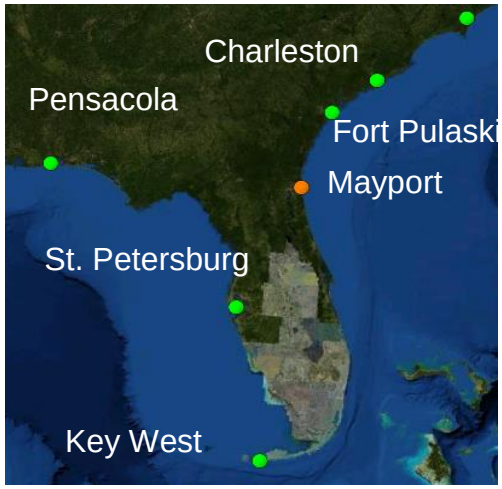


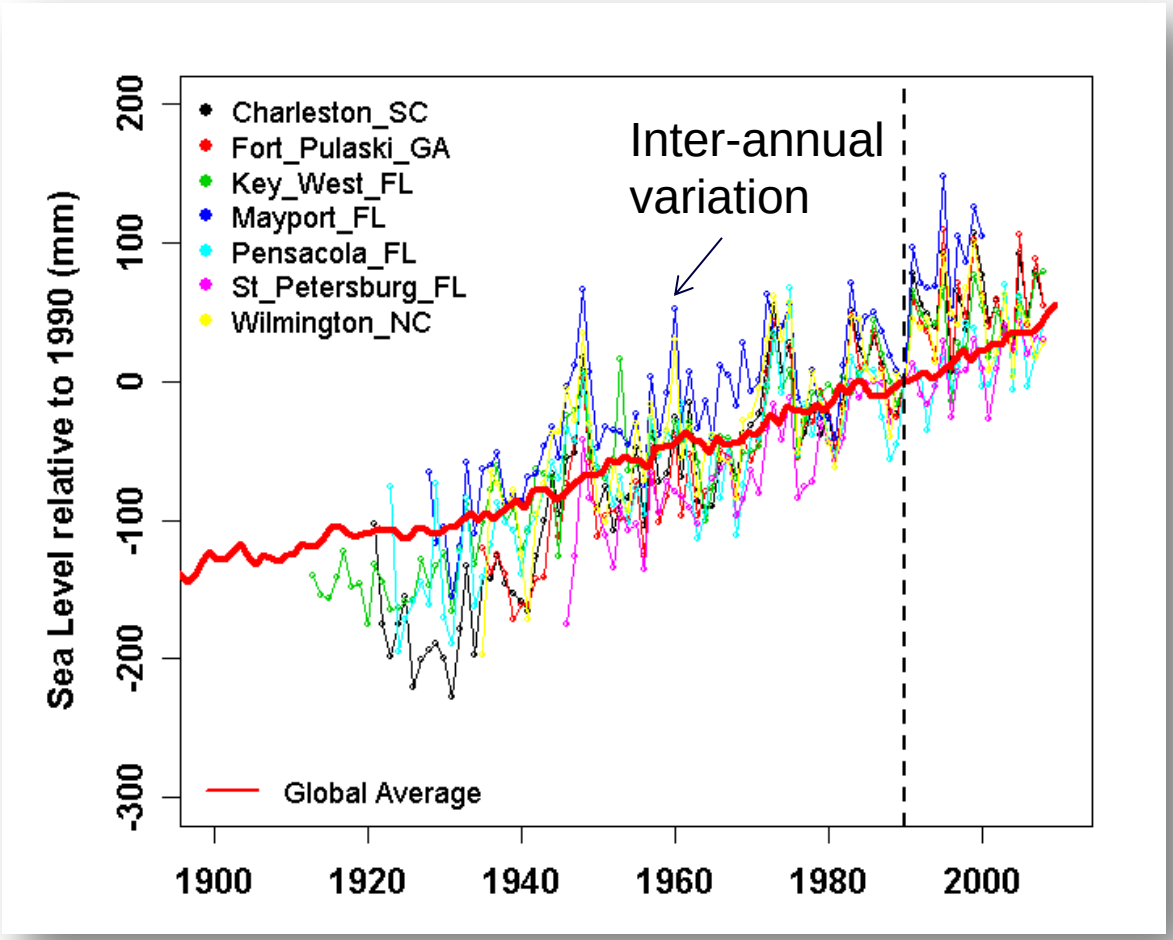

- Recent increase in the rate to > 3 mm/yr is of significant concern for coastal regions

# Sea Level Rise rates in the US

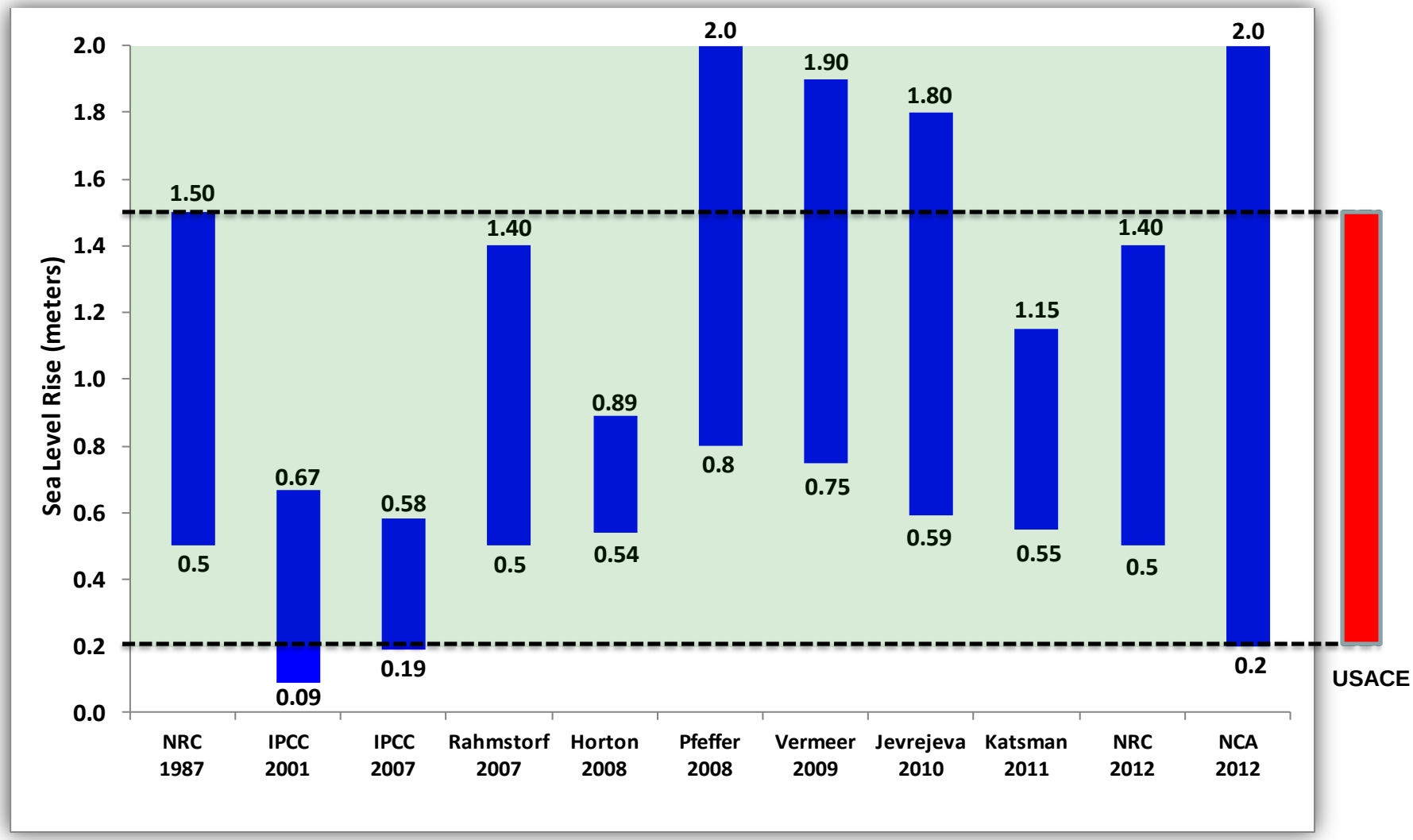


# Trends in Relative Sea Level Rise: Florida

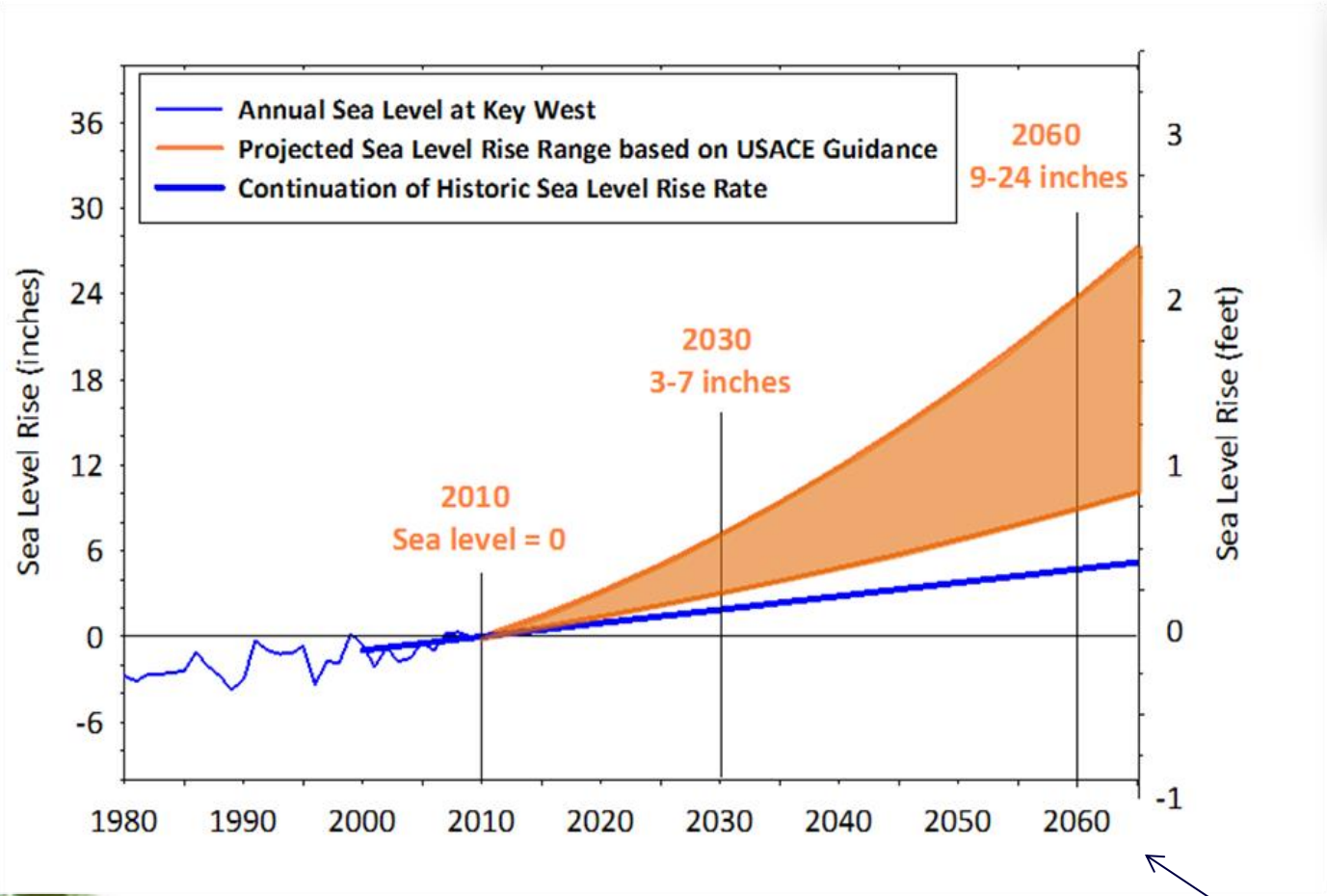


# Future Projections: Considerable Spread (due to uncertainties)



# SE Regional Climate Compact Sea Level Projections (Based on USACE method)

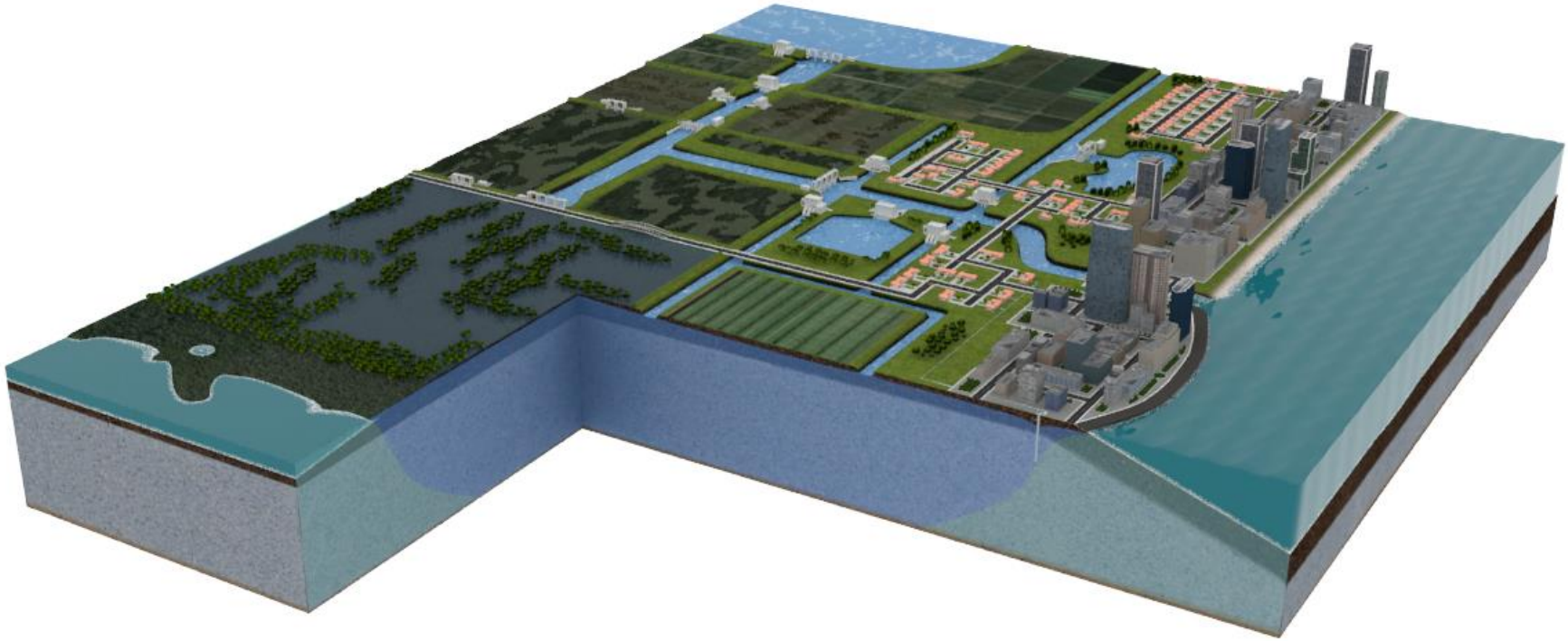



SOUTHEAST FLORIDA REGIONAL COMPACT CLIMATE CHANGE

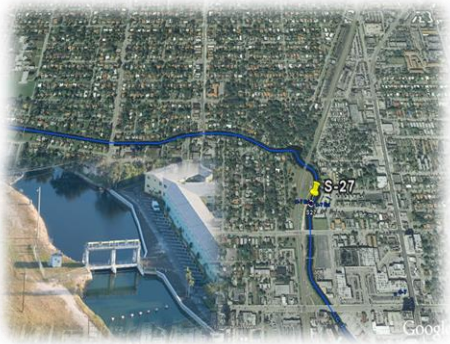
Update underway

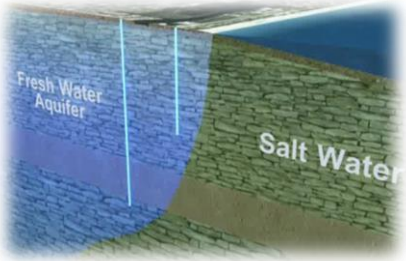
# POTENTIAL IMPACTS ON DISTRICT MISSION

# Today's Regional Water Management System



# Potential Impacts on Water Management from Rising Sea Level



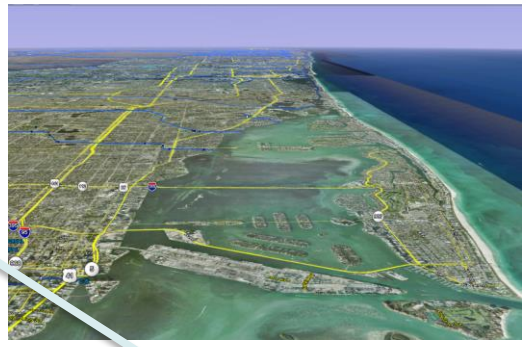



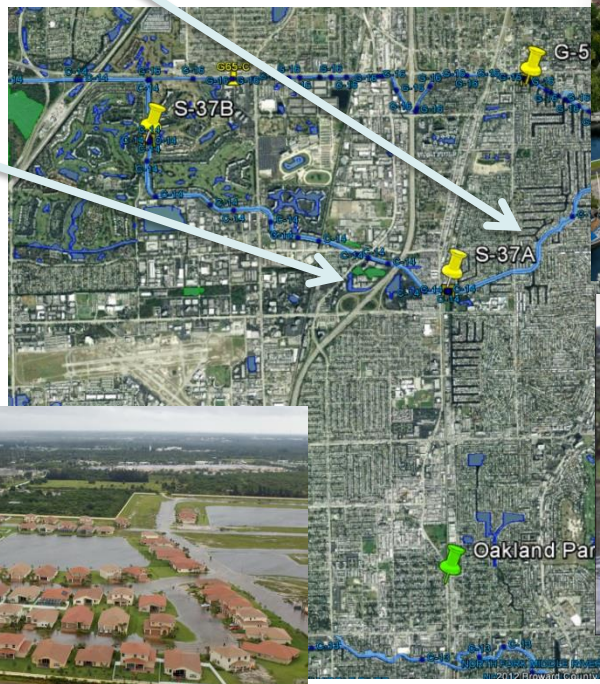


- Flood Protection (flooding, storm surge, hurricanes, coastal structures, groundwater)
- Drinking Water Supply (saltwater intrusion, freshwater wells)
- Natural Environment (Southern Everglades, coastal wetlands)

# Flood Protection: Areas of Concern

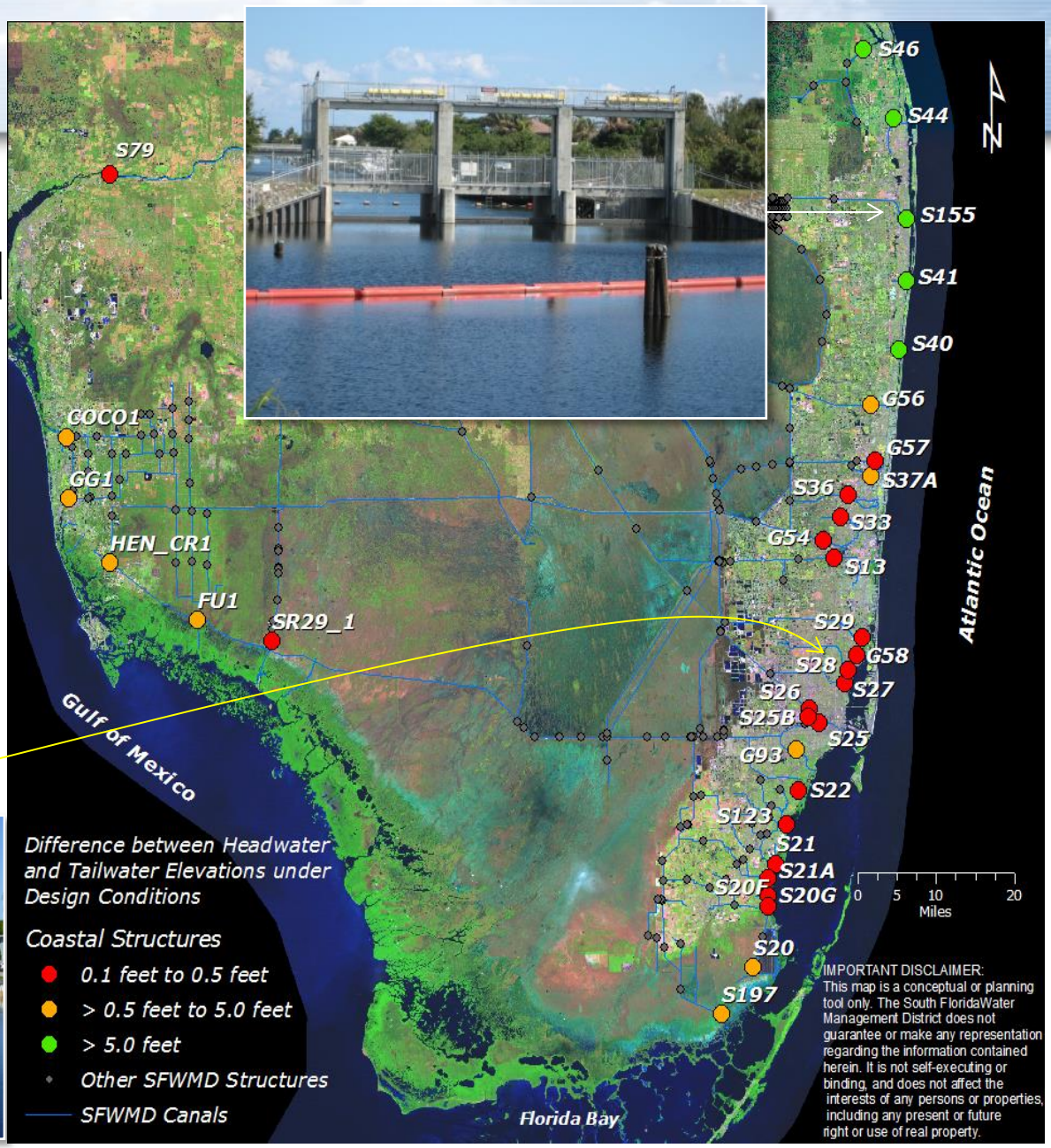
- Island communities
- Areas downstream of SFWMD coastal structures
- Areas served by coastal structures

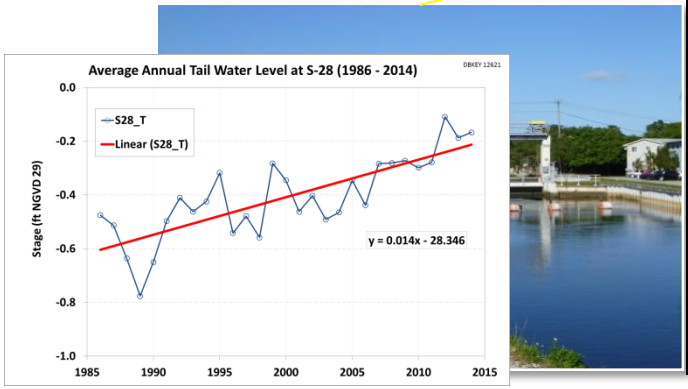




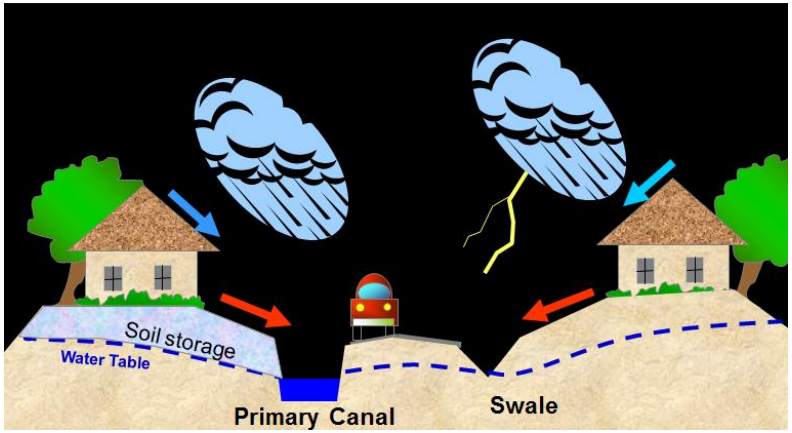

# Exposure & Vulnerability

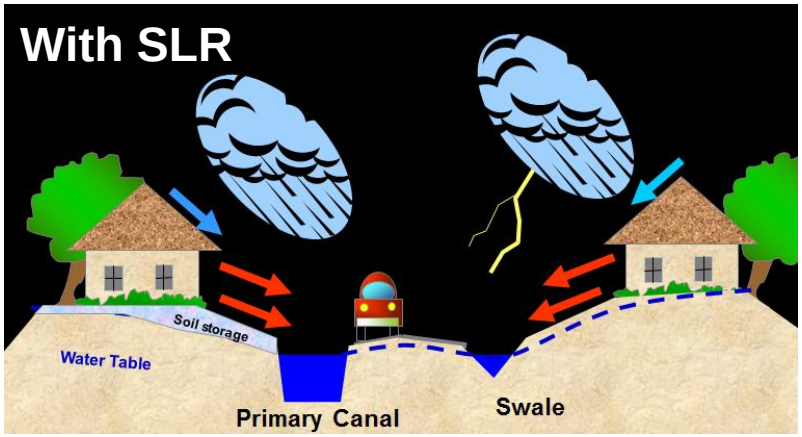
- Screening based on original designs
- Most vulnerable structures are in Miami-Dade and Broward counties



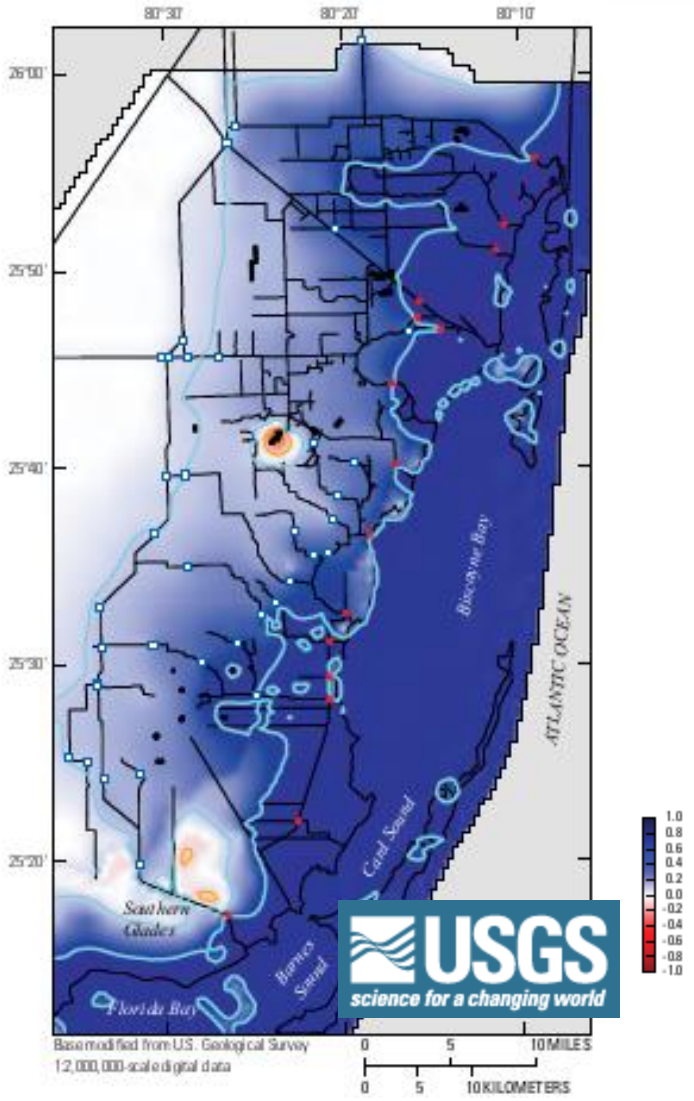



# Non-uniform water table increase

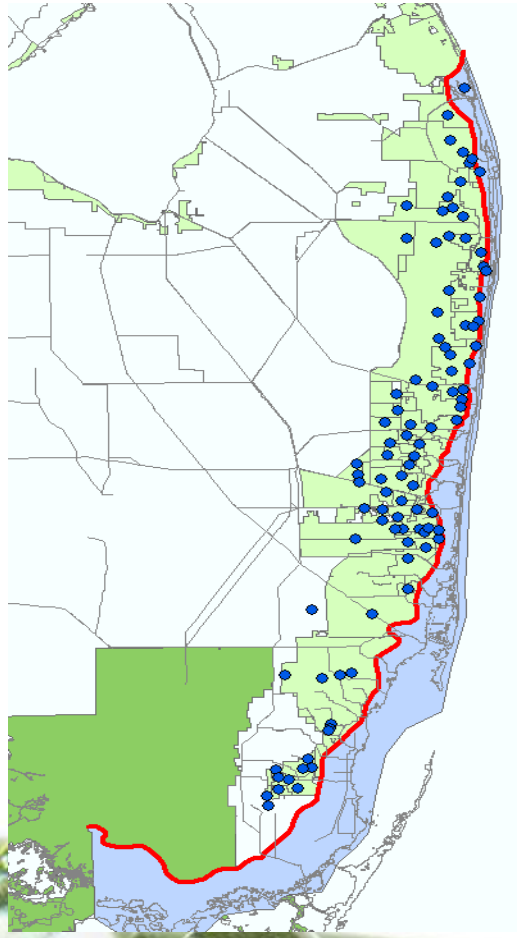


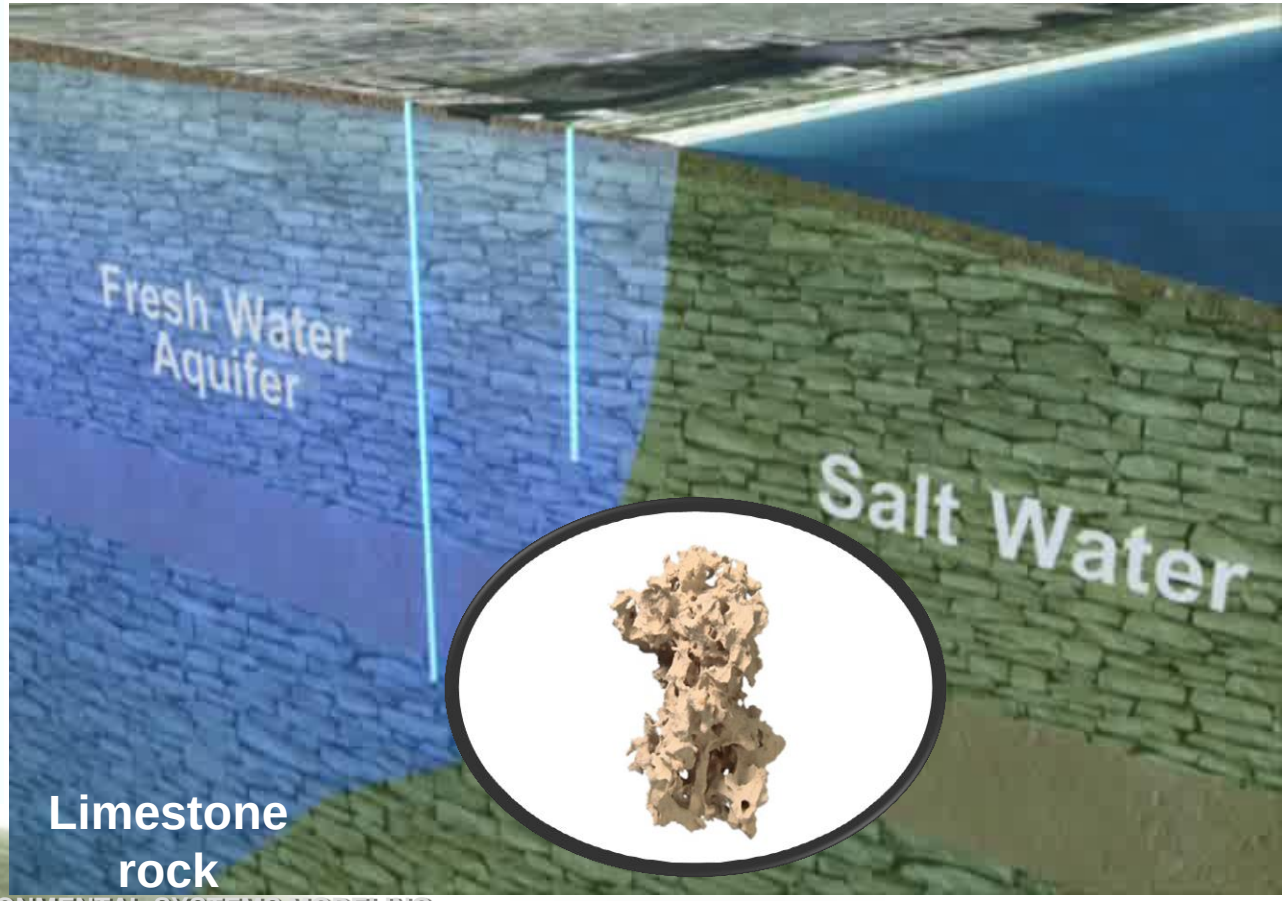

Higher water table
& more runoff



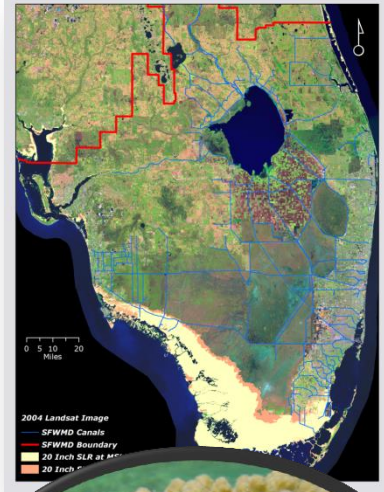
# Water Supply: Saltwater Intrusion



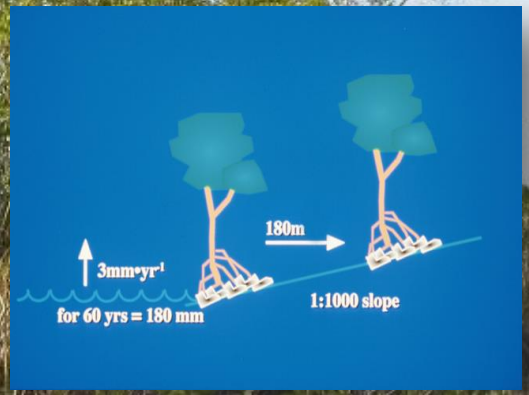
Toe



# Natural Systems: Inundation of Freshwater Wetlands







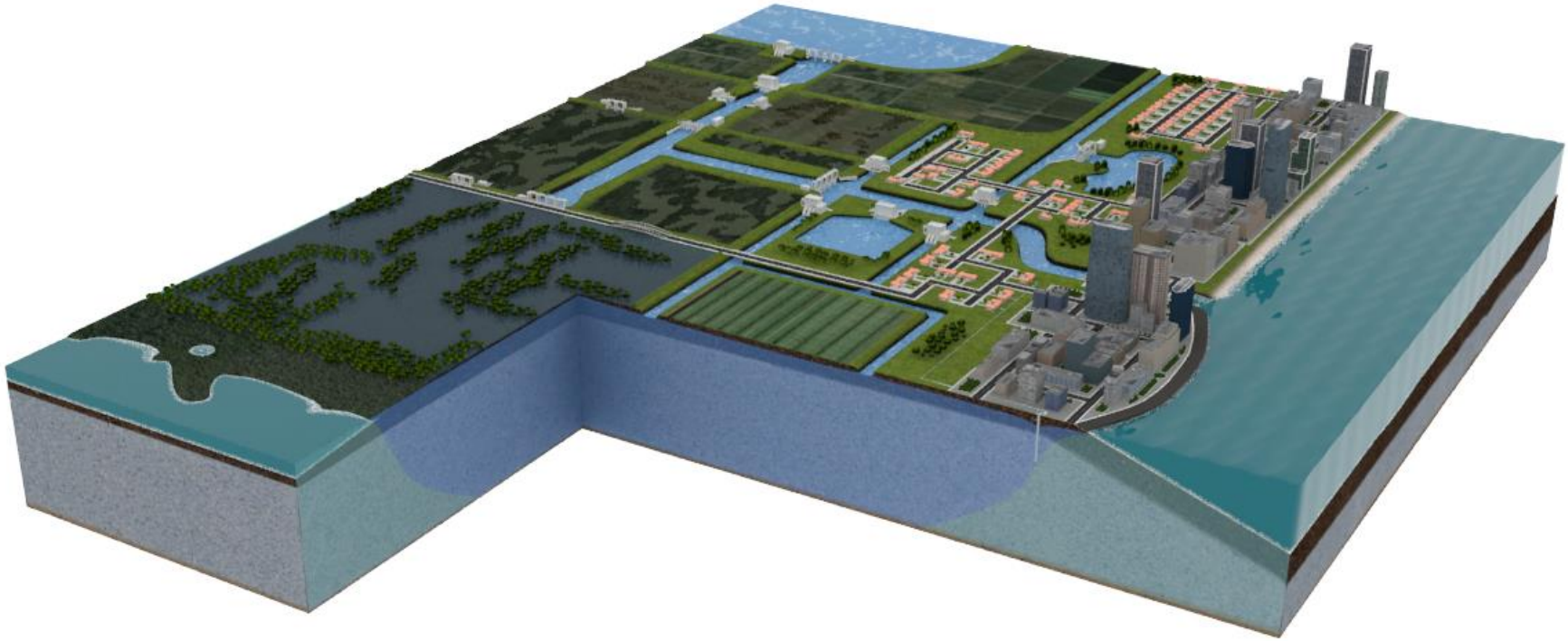

Remnant living sawgrass

peat collapse

Dead sawgrass, substrate decay

Credit: Prof. Hal Wanless

# Potential Impacts on District's Mission (without any adaptation)



# ADAPTATION AND FUTURE STRATEGIES

# Adaptation – Basin Scale

Everglades Restoration

Water Conservation

Impoundments & Pumps ("Room-for-the-River")

Pre-storm drawdown

Forward Pumps

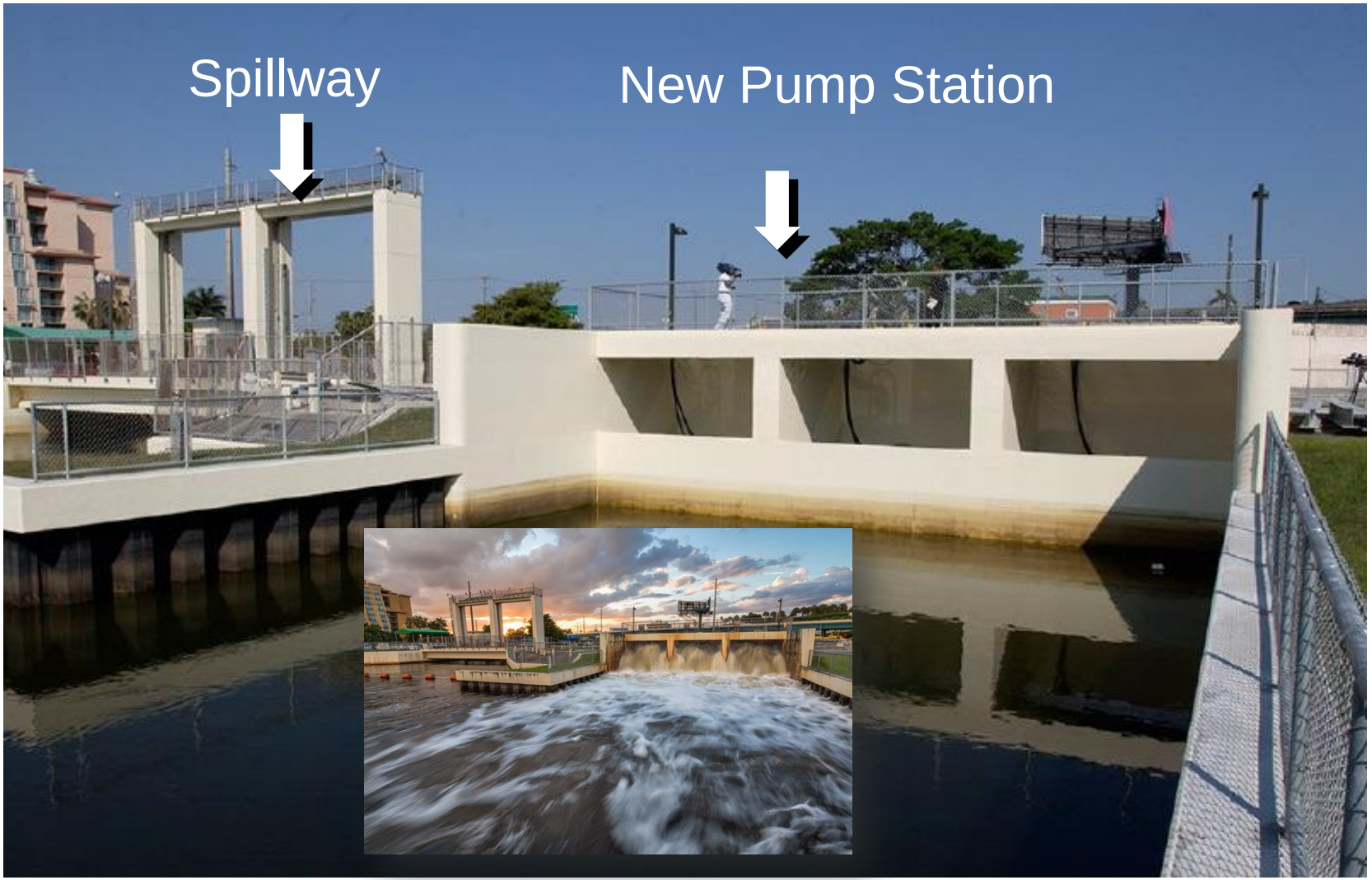
Green Infrastructure (+SF Resilient Workshop ideas)


Revised Stormwater Permitting Criteria

Wellfield relocation/ interconnect/Alternative Water Supply

Higher Seawalls

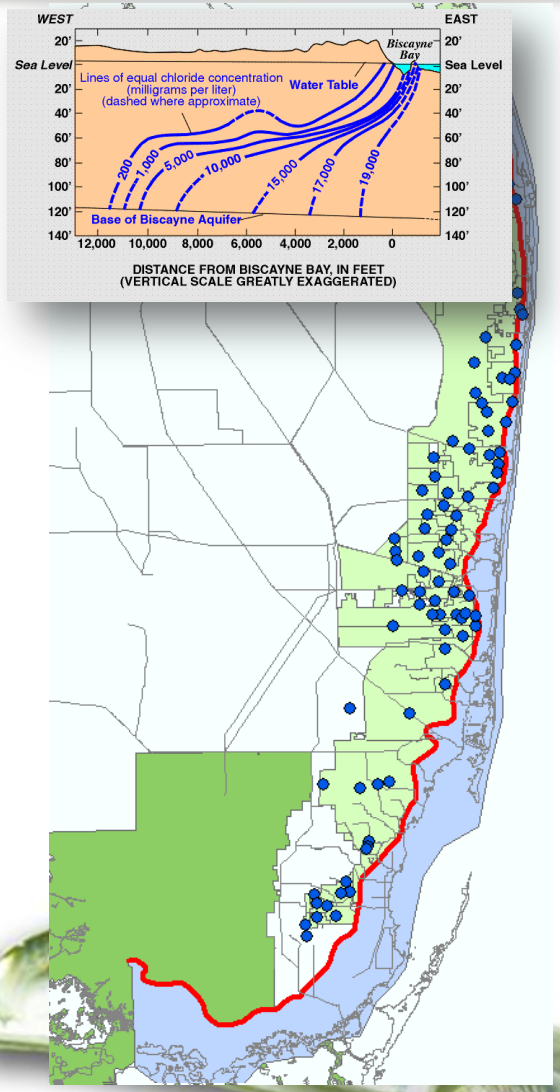
# Adaptation Example: Forward Pumping at S-26 Structure



# Adaptation: Western C-4 Impoundment: Room for storage of excess flood waters

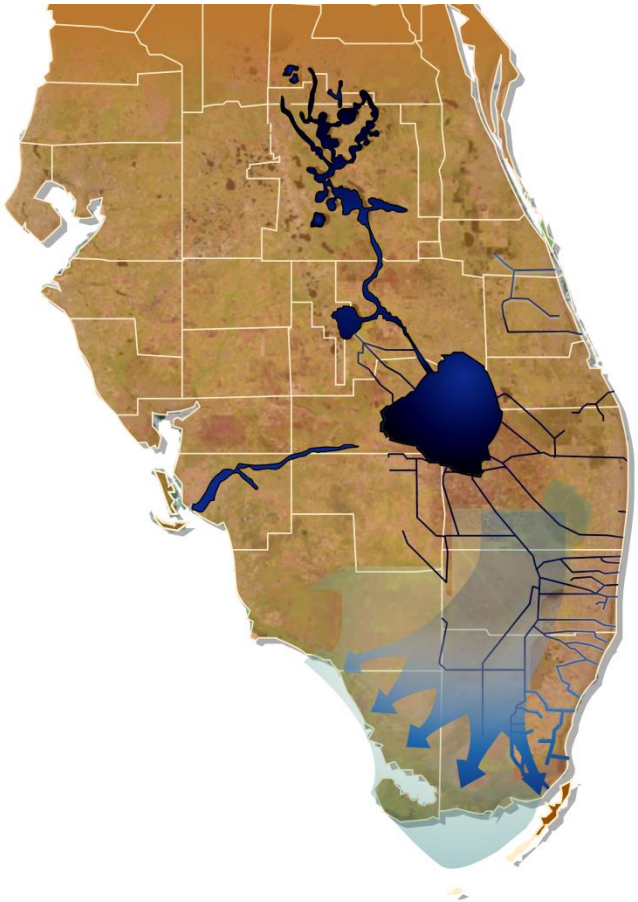
- C-4 Impoundment to excess flood waters temporarily
- Improves flood protection & facilitates recharge

# Saltwater Intrusion: Adaptation



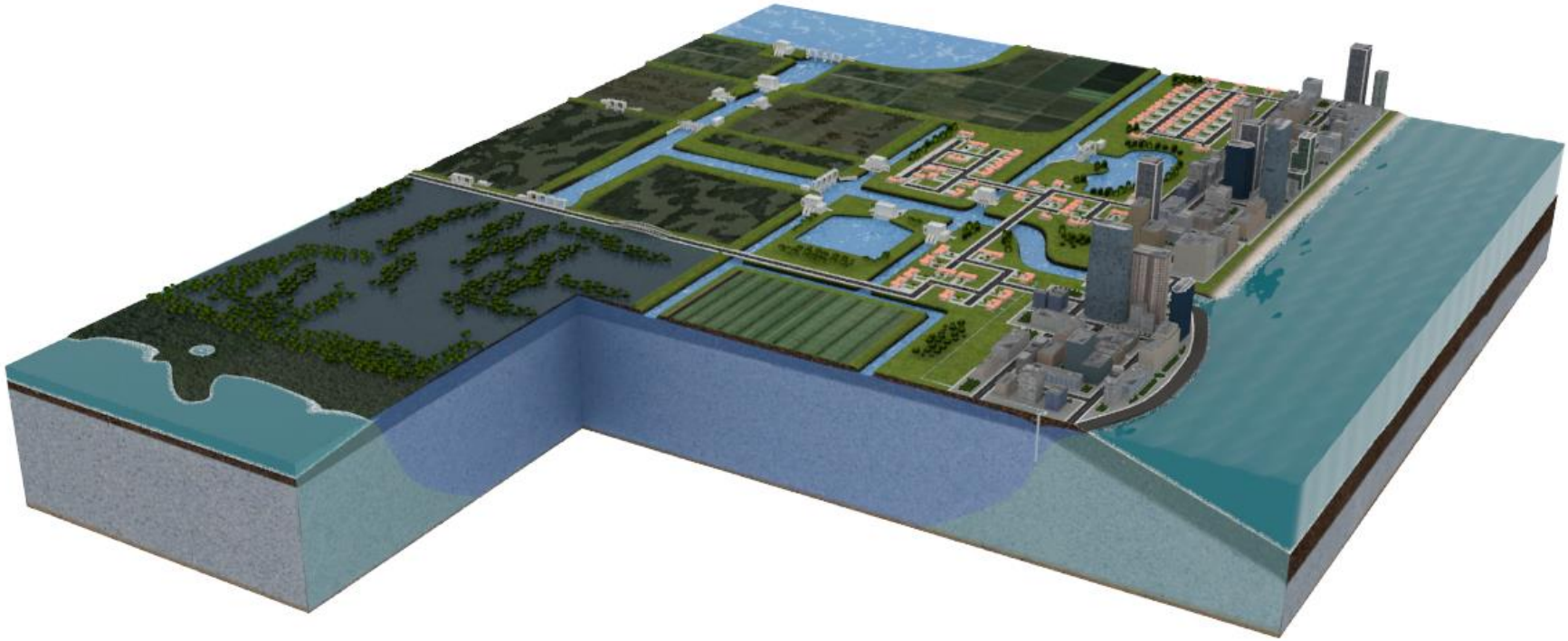

- Determine saltwater/ freshwater interface
- Update saltwater intrusion monitoring network (ongoing)
- Identify utilities at risk
- Emphasize water conservation
- Alternatives sources of water
- Incorporate SLR into water supply planning

# Adaptation Response: Everglades Restoration



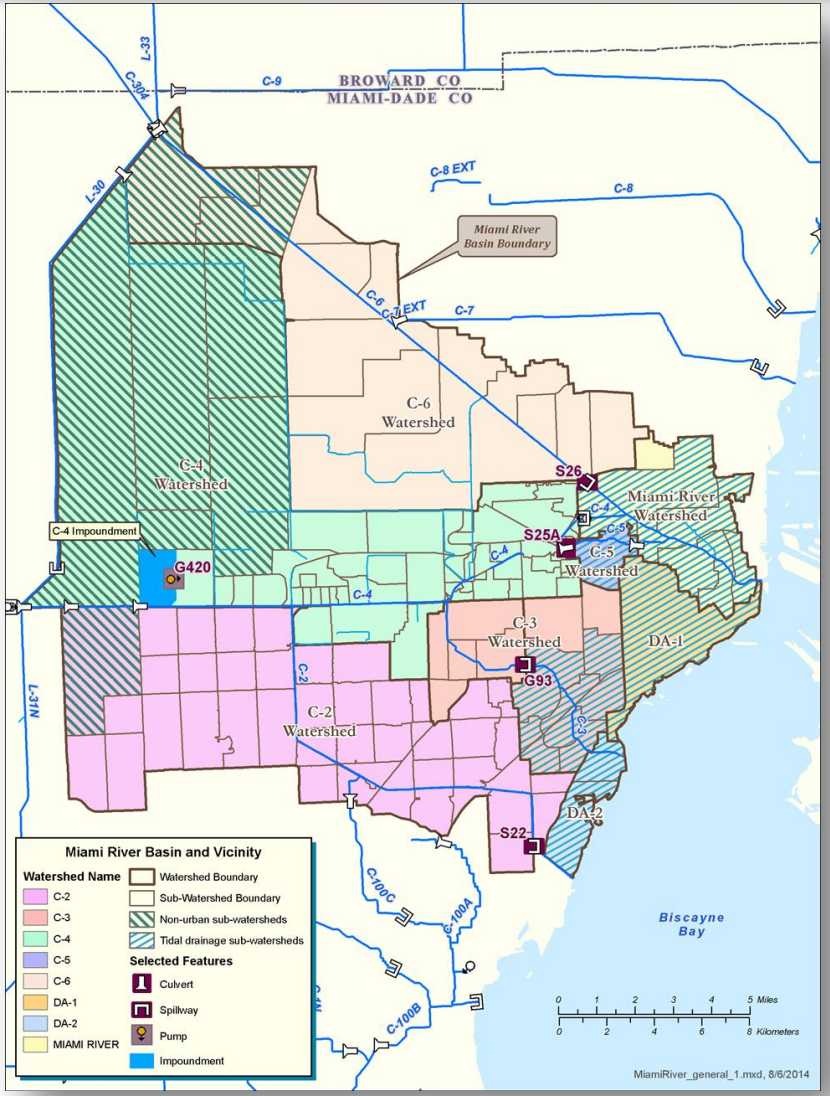
- National Academy of Sciences 2008 report: “Climate change should be a reason to accelerate Everglades restoration, not a reason for delays”
- Everglades restoration is an important adaptation response to sea level rise
- Ecosystem resilience can be enhanced through increased water flows through the Everglades and increased storage
- Increased flows into the southern estuaries will reinstate widespread organic soil formation and maintain the freshwater head in order to mitigate the effects of sea level rise and saltwater intrusion

# Adaptation to Sea Level Rise: Illustration



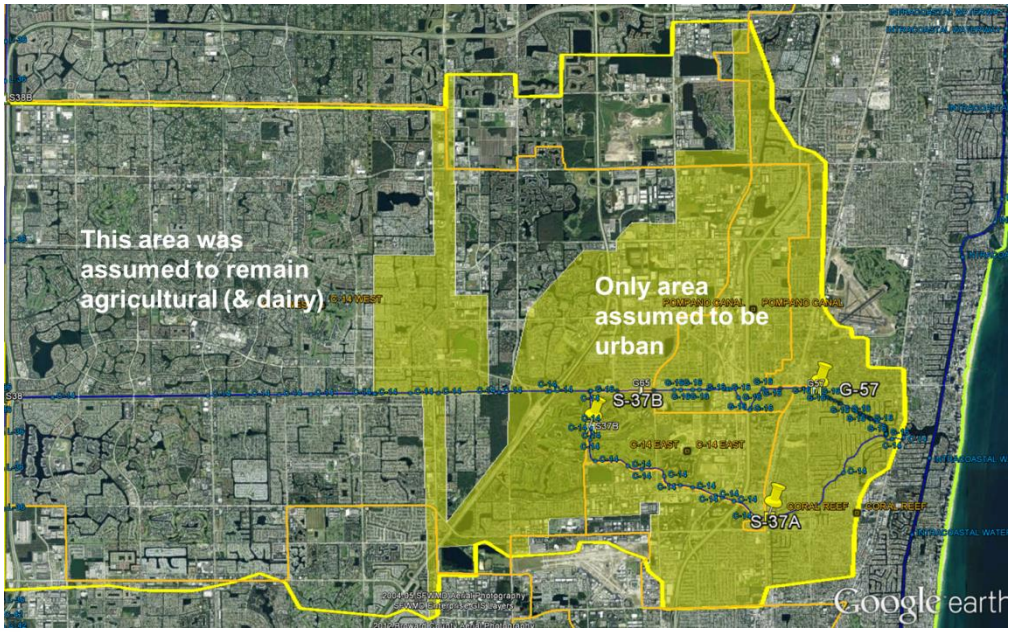
# Adaptation to Regional Flood Projection: Level of Service Assessment

- Screening and prioritization of coastal salinity barriers (completed)
- Interior regions of coastal basins (C-4 basin pilot)
  - Rate of urbanization exceeding assumptions in original designs
  - Rising sea levels
  - Rising water table due to SLR
- Potential changes in extreme rainfall (research topic)



# Flood Protection Level-of-Service: District-Wide Assessment Program

- Original designs are out-of-date
  - unanticipated development and changes in land-use
  - sea level rise and changing rainfall patterns
  - shift to pumped drainage
  - constraints imposed by water supply, environmental and ecological protection



# Flood Protection Level-of-Service: District-Wide Assessment Program

- Evaluate the state and performance of our water management and flood control assets now and under conditions of rising sea levels
- Support the capital program with hydrologic and hydraulic assessment to allow informed decision making
- Develop tools and techniques for assessing the level of service provided by water management district assets and infrastructure, including canals
- Standardize approach for District Wide application.

Progress to date

**Vulnerability Assessment**

- White paper on mission concerns
- Screening of coast structures
- Mapping of saltwater intrusion

**Adaptation**

- Pilot project on Level of Service (C-4)
- Consideration of sea level rise in water supply planning
- SF Resilient Redesign workshop

**Regional Coordination**

- Steering Committee of SE Compact
- Technical assistance for SLR projections, mapping
- DEP + other WMDs committee
- Numerous presentations at local/regional meetings

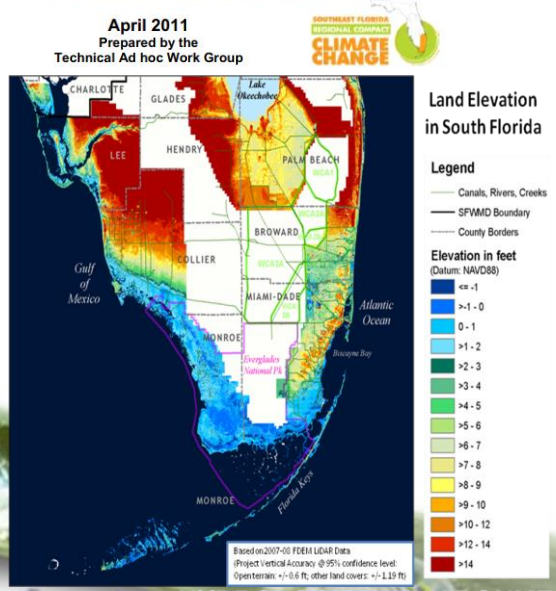
**Science Monitoring/ Communication**

- Continuous monitoring of rapidly evolving science
- MOA for collaboration with the Dutch scientists
- Federal advisory committee (NCADAC)
- Interdepartmental Working Group at the District
- Technical report on past and future trends

**Funding**

- $25K per year during FY14 & FY15
- NOAA grant on flood risk management (via DELTARES)
- FEMA funding via FDEM (pending)

# Regional Coordination: Assistance to SE Climate Compact

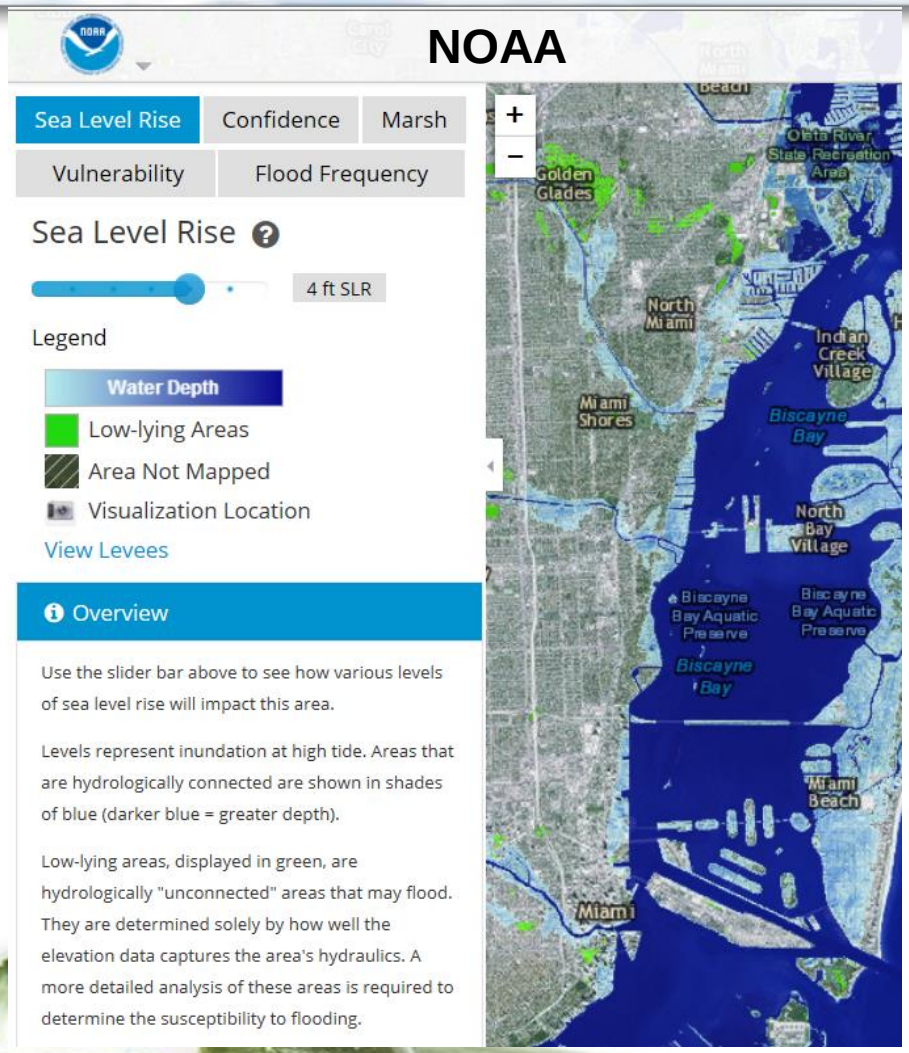

- Southeast Regional Compact:
  - Participation on the scientific panel regarding sea level rise projections
  - Regional datasets of Digital Elevation Model (DEM) data
- Collaboration with the Netherlands – Memorandum of Agreement
- Member of the Steering Committee
- Coordination with other WMDs and DEP

# Future Strategy

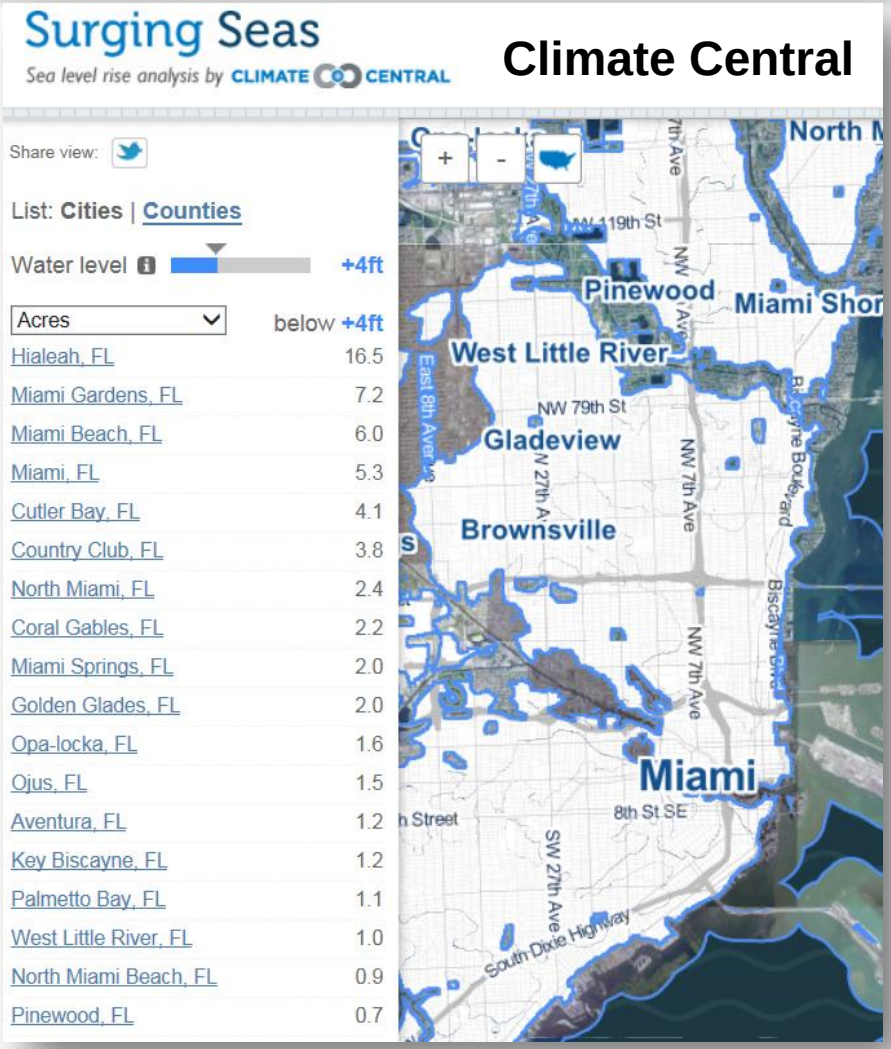
- Extend the pilot project in C-4 basin to other priority basins
- Jointly with local governments, develop actionable adaptation strategies and funding mechanisms
- Continue to monitor science, saltwater intrusion, and facilitate international collaboration
- Continue to provide technical assistance to SE Climate Compact and serve in the steering committee

# Inundation Mapping Tools

## NOAA




## Climate Central



# Questions?